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PATENT ABSTRACTS OF JAPAN

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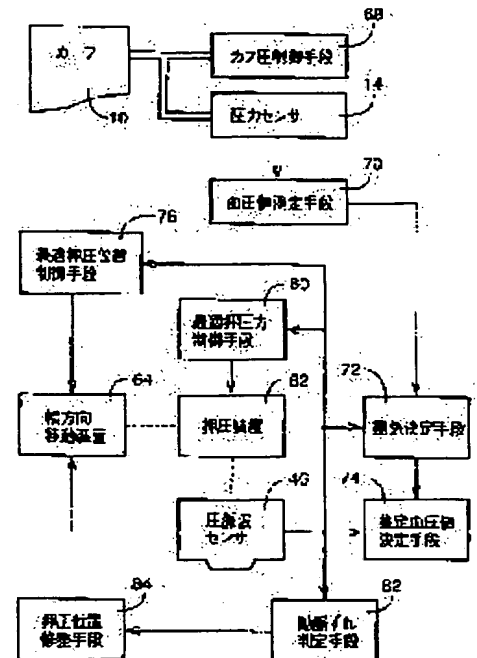
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D) BLOOD VESSEL TRACKING TYPE CONTINUOUSLY BLOOD PRESSURE MONITORING APPARATUS

1) Abstract:

PROBLEM TO BE SOLVED: To provide a blood vessel tracking type continuously pressure monitoring apparatus which enables continuation of monitoring a blood pressure by eliminating any deviation of an artery quickly even when the deviation of the artery is caused under the pressing of a pressure pulse wave sensor during the continuously monitoring of the blood pressure.

SOLUTION: During the continuously monitoring of a blood pressure using estimated blood pressure, when the deviation of a radial artery is terminated by an artery deviation judging means 82 to occur from a pressing surface of a pulse wave sensor 46, the pulse wave sensor 46 is moved to a width-wise moving device 64 by a pressing force position correcting means 84 so that the positional deviation of the pulse wave sensor 46 is reduced with the pressing force of the pressure pulse wave sensor 46 maintained at the optimum value by an optimum pressing force control means 80. This can eliminate the positional deviation of the radial artery from a reference position such as a center position pressure detector on the pressing surface of the pressure pulse wave sensor 46 without activating the optimum pressing force position checking action or an optimum pressing force determining action, thereby achieving a quick continuation of monitoring a blood pressure.



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AIMS

aim(s)]

aim 1] The pressure pulse wave sensor which has two or more pressure sensing elements arranged crosswise [of this artery] in a press side in order to detect the pressure pulse wave generated from a living body's artery, The press equipment which presses this pressure pulse wave sensor toward this artery, and the crosswise migration equipment to move this pressure pulse wave sensor crosswise [this] in order to change the press location where this pressure pulse wave sensor is pressed crosswise [of this artery], An optimal press position control means to locate this pressure pulse wave sensor in the right above location of said artery with said crosswise migration equipment based on the pressure pulse wave detected by said pressure pulse wave sensor, An optimal press force-control means to make said pressure pulse wave sensor press with said press equipment by the optimal thrust beforehand determined that some blood vessel walls of said artery will serve as abbreviation flatness, and to maintain the optimal thrust, It has a presumed blood-pressure value decision means to determine serially this living body's presumed blood-pressure value based on the magnitude of the pressure pulse wave detected by the pressure sensing element of said pressure pulse wave sensor in the relation set up beforehand. It is continuation blood-pressure supervisory equipment which supervises said living body's blood-pressure value continuously with this presumed blood-pressure value. In the condition that the thrust of said pressure pulse wave sensor is maintained by said optimal thrust with said optimal press force-control means, and the living body's presumed blood-pressure value is determined by said presumed blood-pressure value decision means, the artery gap judging means to judge the location gap to the press side of this pulse wave sensor of said artery, When the gap to the press side of said pulse wave sensor of said artery is judged by this artery gap judging means, Blood vessel mold continuation blood-pressure supervisory equipment characterized by including a press location correction means to move this pulse wave sensor to said crosswise migration equipment so that a location gap of said artery may be released in the condition [that the thrust of said pressure pulse wave sensor is maintained by said optimal thrust with said optimal press force-control means].

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TAILED DESCRIPTION

Detailed Description of the Invention]

[01]

Industrial Application] This invention is in the condition which is supervising a living body's blood-pressure value continuously, and when the artery currently pressed by the pressure pulse wave sensor shifted and moves, it relates to continuation blood-pressure supervisory equipment of the format which pursues and presses the artery.

[02]

Description of the Prior Art] The pressure pulse wave sensor which has two or more pressure sensing elements arranged crosswise [of the artery] in a press side in order to detect the pressure pulse wave generated from a living body's artery, The press equipment which presses the pressure pulse wave sensor toward the artery, and the crosswise migration equipment to which the above-mentioned pressure pulse wave sensor is moved crosswise in order to change press location where the pressure pulse wave sensor is pressed crosswise [of the above-mentioned artery], An optimal press position control means to locate this pressure pulse wave sensor in the right above location of said artery with said crosswise migration equipment based on the pressure pulse wave detected by said pressure pulse wave sensor, optimal press force-control means to make said pressure pulse wave sensor press by the optimal thrust from which the blood vessel walls of said artery serve as abbreviation flatness with said press equipment, and to maintain the optimal thrust, It has a presumed blood-pressure value decision means to determine serially the living body's presumed blood-pressure value based on the magnitude of the pressure pulse wave detected by the pressure sensing element of said pressure pulse wave sensor from the relation set up beforehand. The continuation blood-pressure supervisory equipment which supervises said living body's blood-pressure value continuously with the presumed blood-pressure value is known. For example, the continuation blood-pressure supervisory equipment indicated by JP,8-187230,A etc. is

[03]

Problem(s) to be Solved by the Invention] By the way, since it is easy to move the artery pushed in by press of a pressure pulse wave sensor toward a living body's inside to the outside of the press side when the press side of a pressure pulse wave sensor inclines in relation to a body motion etc., the above-mentioned artery may shift suddenly to the press side of a pressure pulse wave sensor by contact to a body motion or a pressure pulse wave sensor during a continuation blood-pressure monitor. For this reason, in conventional continuation blood-pressure supervisory equipment, after stopping press of a pressure pulse wave sensor and making it isolated from a living body's skin by turning optimal press localization actuation and optimal thrust decision actuation, the check of the optimal press location and the decision of the optimal press location were made by making it move to the migration side of a blood vessel slightly, and making a pressure pulse wave sensor press again. For this reason, the inconvenience that the above-mentioned continuation blood-pressure monitor was interrupted was within the period when check actuation of these optimal press location and optimal thrust decision actuation are performed.

[04] The place which succeeds in this invention against the background of the above situation, and is made into the object is to offer the blood vessel trace mold continuation blood-pressure supervisory equipment with which a gap of an artery is promptly canceled and a continuation blood-pressure monitor is continued, even if the artery currently pressed by the pressure pulse wave sensor shifts during a continuation blood-pressure monitor.

[05]

Means for Solving the Problem] The place made into the summary of this invention for attaining this object The pressure pulse wave sensor which has two or more pressure sensing elements arranged crosswise [of the artery] in a press side in order to detect the pressure pulse wave generated from a living body's artery, The press equipment which presses the pressure pulse wave sensor toward the artery, and the crosswise migration equipment made to move the

pressure pulse wave sensor crosswise [the] in order to change the press location where the pressure pulse wave sensor is pressed crosswise [of the artery], An optimal press position control means to locate the pressure pulse wave sensor on the right above location of said artery with said crosswise migration equipment based on the pressure pulse wave detected by said pressure pulse wave sensor, An optimal press force-control means to make said pressure pulse wave sensor press with said press equipment by the optimal thrust beforehand set up so that some blood vessel walls of said artery might serve as abbreviation flatness, and to maintain the optimal thrust, It has a presumed blood-pressure value decision means to determine serially the living body's presumed blood-pressure value based on the magnitude of the pressure pulse wave detected by the pressure sensing element of said pressure pulse wave sensor from the relation set up beforehand. It is continuation blood-pressure supervisory equipment which supervises said living body's blood-pressure value continuously with the presumed blood-pressure value. (a) The thrust of said pressure pulse wave sensor is maintained by said optimal thrust with said optimal press force-control means. With and said presumed blood-pressure value decision means An artery gap judging means to judge the location gap to the criteria location of the press side of said pressure pulse wave sensor of said artery in the condition that said living body's presumed blood-pressure value is determined serially, (b) When the gap to the press side of said pulse wave sensor of said artery is judged by the artery gap judging means It is in including a press location correction means to move this pulse wave sensor to said crosswise migration equipment so that a location gap of said artery may decrease in the condition [that the thrust of said pressure pulse wave sensor is maintained by said optimal thrust with said optimal press force-control means].

[06]

[Effect of the Invention] If it does in this way, when the gap to the press side of said pulse-wave sensor of said artery is judged [be / it / under / by presumed blood pressure / continuous blood-pressure monitor / setting] by the artery gap judging means, the pulse-wave sensor will be moved by said crosswise migration equipment so that a location gap of said pulse-wave sensor may decrease with a press location correction means in a condition [that the thrust of said pressure pulse wave sensor is maintained by said optimal thrust with said optimal press force-control means]. Therefore, since the location gap to the criteria location of the press side of the pressure pulse wave sensor of said artery is canceled without starting optimal press localization actuation and optimal thrust decision actuation, a blood-pressure monitor is continued promptly.

[07]

[Other modes of invention] Suitably here said presumed blood-pressure value decision means The inside of two or more pressure sensing elements arranged in the press side of the criteria blood-pressure-measurement value measured using a cuff, and said pressure pulse wave sensor, From the relation with the magnitude of the pressure pulse wave detected by the center position pressure sensing element which outputs the maximum pulse wave amplitude in comparatively low thrust lower than the optimal thrust called for beforehand Based on the magnitude of the pressure pulse wave outputted from the center position pressure sensing element, said living body's presumed blood-pressure value is determined serially.

[08] Moreover, said artery gap judging means is in the condition that the thrust of said pressure pulse wave sensor is maintained by said optimal thrust with said optimal press force-control means, and said living body's presumed blood-pressure value is determined by said presumed blood-pressure value decision means, suitably. It is based on the pressure pulse wave detected by two or more pressure sensing elements of said pressure pulse wave sensor. a 2-dimensional coordinate with the location shaft in which the location of the amplitude shaft in which the amplitude of the pressure pulse wave is shown, and the above-mentioned pressure sensing element is shown -- it is and the relation between the amplitude of the pressure pulse wave and the location of a pressure sensing element is shown -- It asks, the amplitude distribution curve, i.e., the tonogram, in a press side, and the location gap to the criteria location of the press side of said artery is judged based on the symmetric property centering on the center line with which the amplitude distribution curve was set up beforehand.

[09] Suitably said artery gap judging means Moreover, the inside of said amplitude distribution curve, Each change in addition of the area of the couple of the predetermined section of the both sides said whose center lines are pinched, for example, area SL of the couple of the predetermined section of the both sides said whose center lines in an amplitude distribution curve when said pressure pulse wave sensor is pressed by said press equipment by said optimal thrust with said optimal press force-control means are pinched And SR Difference, Or area SL of these couples And SR Change rate $\Delta SL / SL$ And $\Delta SR / SR$ A difference or area increment ΔSL of the predetermined section of the both sides said whose center lines in a actual amplitude distribution curve are pinched And ΔSR A gap of an artery is judged based on a ratio.

[10]

[Example] Hereafter, one example of this invention is explained to a detail based on a drawing.

11] Drawing 1 is drawing showing the example of 1 configuration of the continuation blood-pressure supervisory equipment of this invention, for example, it is used in order to supervise under an operation, the condition of the patient or an operation, the living body under exercise stress test, etc. In drawing, 10 is a cuff which has rubber bag-making the band-like bag made of cloth, for example, it is equipped with it in the condition of having been wound around a patient's overarm section 12. The pressure sensor 14, the exhaust air control valve 16, and the air pump 18 are connected to the cuff 10 through piping 20, respectively. The exhaust air control valve 16 is constituted so that it may be switched to three conditions, the pressure supply condition of permitting supply of the pressure into a cuff 10, the **** exhaust-pressure condition which carries out exhaust gas pressure of the inside of a cuff 10 gradually, and the rapid exhaust-pressure condition which carries out exhaust gas pressure of the inside of a cuff 10 quickly.

12] A pressure sensor 14 supplies the pressure signal SP with which the pressure in a cuff 10 is detected and the pressure is expressed to the static pressure discriminator 22 and the pulse wave discriminator 24, respectively. The static pressure discriminator 22 is equipped with the low pass filter, discriminates from the cuff pressure signal SK showing steady pressure contained in the pressure signal SP, and supplies the cuff pressure signal SK to an arithmetic sequence unit 28 through A/D converter 26. It is the pulse wave signal SM 1 which the pulse wave discriminator 24 is equipped with the band pass filter, and is the oscillating component of the pressure signal SP. It discriminates and is the pulse wave signal SM 1. An arithmetic sequence unit 28 is supplied through A/D converter 30. This pulse wave signal SM 1 The cuff pulse wave to express is a pressure oscillatory wave which occurs from the brachial artery which is not illustrated synchronizing with a patient's heartbeat, and is transmitted to a cuff 10, and the above-mentioned pulse wave discriminator 24 is functioning as a cuff pulse wave detection means.

13] The above-mentioned arithmetic sequence unit 28 consists of so-called microcomputers equipped with CPU29, ROM31, RAM33, the I/O Port that is not illustrated, and CPU29 controls the exhaust air control valve 16 and an air pump 18 by performing signal processing through the actuation circuit which does not output and illustrate a driving signal from an I/O Port, using the memory storage function of RAM33 for ROM31 according to the program memorized beforehand. Pulse wave signal SM 1 which is made to carry out **** pressure lowering at the rate of 3 mmHg/sec extent on the occasion of the blood pressure measurement using a cuff 10 after carrying out rapid pressure up the pressure in a cuff 10, for example to the predetermined target pressure force, and is serially extracted in the **** pressure-lowering process Based on change of the pulse wave to express, blood-pressure values, such as a highest-blood-pressure value and a lowest-blood-pressure value, are determined by the oscillometric method, and the determined blood-pressure value is displayed on a drop 32.

14] The pressure pulse wave detection probe 34 is equipped with the screw-thread shaft 41 by which revolution actuation is carried out by the motor which was screwed in that sensor housing 36, and was formed in the actuator 39 of case 37, and which is not illustrated in order to move the case 37 where the sensor housing 36 which constitutes the shape of a container is held, and this sensor housing 36 crosswise [of a radial artery 56], as shown in drawing 2 in detail. The wearing band 40 is attached in the above-mentioned case 37, and it is attached in a wrist, the side, for example, the left-hand side, where the cuff 10 is not wound with the wearing band 40 in the condition that the opening shape of the sensor housing 36 which constitutes the shape of an above-mentioned container counters the body surface of the body, 42 removable. It is prepared in the interior of the above-mentioned sensor housing 36 through diaphragm 44 that the pressure pulse wave sensor 46 can be displaced relatively and possible [the projection from the opening shape of the sensor housing 36], and the pressure room 48 is formed in it of these sensors housing 36 and diaphragm 44. In this pressure room 48, pressure air is supplied through a pressure regulating valve 52 from an air pump 50, thereby, the pressure pulse wave sensor 46 is pressed by said body surface 38 by the thrust according to the pressure in the pressure room 48. In addition, at this example, the thrust of the pressure pulse wave sensor 46 is shown the pressure in the pressure room 48 (unit: mmHg).

15] The above-mentioned sensor housing 36 and diaphragm 44 constitute the press equipment 62 which presses the pressure pulse wave sensor 46 toward a radial artery 56, and the above-mentioned screw-thread shaft 41 and the motor which is not illustrated constitute, the press repositioning equipment 64, i.e., the crosswise migration equipment, which moved crosswise [of the radial artery 56] and changes the press location where the pressure pulse wave sensor 46 is pressed.

16] The above-mentioned pressure pulse wave sensor 46 for example In the cross direction of a radial artery 56, i.e., migration direction of the pressure pulse wave sensor 46 parallel to the screw-thread shaft 41, many semi-conductor pressure sensitive devices (not shown) are arranged at intervals of [fixed] about 0.2mm, and are constituted by the press side 54 which consists of the semiconductor chip which consists of single crystal silicon etc. Pressure pulse wave signal SM 2 with which it detects, the pressure oscillatory wave, i.e., the pressure pulse wave, which occurs from a radial artery 56 and is transmitted to a body surface 38 by being pressed on the radial artery 56 of the body surface 38 of

rist 42, and the pressure pulse wave is expressed An arithmetic sequence unit 28 is supplied through A/D converter It is the pressure pulse wave SM 2 by which drawing 3 was detected, by the pressure pulse wave sensor 46. An ample is shown.

17] CPU29 of an arithmetic sequence unit 28 performs signal processing, using the memory storage function of M33 for ROM31 according to the program memorized beforehand, outputs a driving signal through the actuation unit which is not illustrated to an air pump 50 and a pressure regulating valve 52, and adjusts the pressure in the pressure room 48. An arithmetic sequence unit 28 determines the optimal thrust PHDPO of the pressure pulse wave sensor 46 for making some blood vessel walls of a radial artery 56 into abbreviation flatness on the occasion of a continuation blood-pressure monitor based on the pressure pulse wave serially obtained in the **** pressure variation process in the pressure room 48, and controls a pressure regulating valve 52 to maintain the optimal thrust PHDPO. Moreover, highest-blood-pressure value BPSYS by which the arithmetic sequence unit 28 was measured using the cuff And lowest-blood-pressure value BPDIA By the center position pressure sensing element (active element) located at above the radial artery 56 of the semi-conductor pressure sensitive devices of the pressure pulse wave sensor 46 are the above-mentioned optimal thrust PHDPO is maintained It asks for the response relation between the blood-pressure values BP and magnitude PM (absolute value) of a pressure pulse wave which were measured based on the peak price PMmax and the minimum value PMmin of the detected pressure pulse wave. From this response relation By pressure pulse wave sensor 46 It is based on magnitude PM (top peak value) PMmax, i.e., (mmHg), the peak price, the minimum value (bottom peak value) PMmin of a pressure pulse wave which are detected serially, and is the highest-blood-pressure value MBPSYS. And the lowest-blood-pressure value MBPDIA (a presumed blood-pressure value, i.e., a monitor blood-pressure value) is determined serially. It sets to a drop 32 and is the determined highest-blood-pressure value MBPSYS. And lowest-blood-pressure value MBPDIA A digital readout is carried out for every t, and the wave which shows the presumed blood-pressure value MBP is displayed continuously.

18] The relation corresponding to the above is shown in drawing 4, and is expressed by the formula 1. In this formula 1, the constant A indicates an inclination to be, and B are constants which show an intercept.

19]

Equation 1] $MBP=A \cdot PM+B$ [0020] Drawing 5 is a functional block diagram explaining the important section of the control function of the arithmetic sequence unit 28 in the continuation blood-pressure supervisory equipment constituted mentioned above. In drawing, the compression pressure force of the cuff 10 changed by the cuff pressure control means 68 on the occasion of blood pressure measurement is detected by the pressure sensor 14. The blood-pressure value measurement means 70 measures a living body's highest-blood-pressure value BPSYS, the mean-blood-pressure value BPMEAN, and the lowest-blood-pressure value BPDIA (criteria blood-pressure value) according to an allometric method based on the pulse synchronizing signal obtained in the process in which the compression pressure by the cuff 10 is gradually changed at the rate of 2 - 3 mmHg/sec extent, for example, the pulse wave amplitude.

21] The related decision means 72 is magnitude PM of the pressure pulse wave detected by the center position pressure sensing element (active element) among two or more pressure sensing elements arranged in the press side 54 of pressure pulse wave sensor 46. The response relation between the blood-pressure values BP measured by the blood-pressure value measurement means 70 is beforehand determined, as shown in drawing 4. The presumed blood-pressure value decision means 74 determines continuously a living body's presumed blood-pressure value MBP from the response relation based on the magnitude of the pressure pulse wave detected by the above-mentioned center position pressure sensing element among two or more pressure sensing elements arranged in the press side 54 of the pressure pulse wave sensor 46.

22] A location [as opposed to the radial artery 56 of the pressure pulse wave sensor 46 in the optimal press position control means 76] shifts greatly. When the predetermined renewal conditions of a press location at the time of coming that to which what detects the maximum amplitude of the pressure sensing elements arranged in the press side is located in the edge of the array locations etc. (APS starting conditions) are satisfied The comparatively small 1st press value P1 beforehand set up in the pressure pulse wave sensor 46 by press equipment 62 lower enough than the initial thrust It is made to press. It judges whether what shows the maximum pulse wave amplitude in the condition among each pressure sensing element of the pressure pulse wave sensor 46 is located in the center section beforehand up in the array direction of the pressure sensing element. When the decision is denied (i.e., when not located in the center section), while making the pressure pulse wave sensor 46 once isolate from a body surface 38, after moving the pressure pulse wave sensor 46, above-mentioned actuation and decision are performed again. However, since it is in the condition that the optimal press location was obtained when that the above-mentioned decision indicates the maximum pulse wave amplitude to be among each pressure sensing element of the affirmation **** case 46, i.e., a pressure pulse wave sensor, is located in the center section beforehand set up in the array direction of the pressure sensing element

While setting up the pressure sensing element which outputs the above-mentioned maximum pulse wave amplitude as a 1-gear pressure sensing element (active element) and memorizing it, actuation of the optimal press force-control means 80 is permitted.

[23] The optimal press force-control means 80 changes continuously the thrust of the pressure pulse wave sensor 46 actuated by the optimal press location with the optimal press position control means 76, determines the optimal thrust based on the pressure pulse wave obtained by the process, and makes the pressure pulse wave sensor 46 press by the optimal thrust PHDPO. As the optimal thrust PHDPO, for example, the press value of centering on maximum of pulse wave amplitude obtained from active element of pressure pulse wave sensor 46 like above-mentioned increment fault in first continuation as shown in drawing 6 predetermined within the limits, And/or, pressure pulse wave signal SM 2 required by the thrust process. It is the press value of centering on center of flat part formed in curve (broken line of drawing 6) which connects the bottom peak value SMmin in topographic contour plot table showing bottom peak value SMmin and thrust of pressure pulse wave sensor 46 predetermined within the limits.

[24] The artery gap judging means 82 is in the condition that the thrust of the pressure pulse wave sensor 46 is maintained by said optimal thrust with said optimal press force-control means 80, and said living body's presumed blood-pressure value is serially determined by said presumed blood-pressure value decision means 74, and judges the location gap to the criteria location, for example, the mid gear, of the press side 54 of said radial artery 56. [of the pressure pulse wave sensor 46] Namely, the above-mentioned artery gap judging means 82 is based on the pressure pulse wave detected by the pressure sensing element of the pressure pulse wave sensor 46, respectively. It is, for example, a 2-dimensional coordinate with the location shaft (axis of abscissa) in which the location of the amplitude distribution (axis of ordinate) in which the amplitude of a pressure pulse wave as shown in drawing 7 is shown, and the above-mentioned pressure sensing element is shown -- The amplitude distribution curve in the press side 54 which shows the relation between the amplitude of the pressure pulse wave and the location of a pressure sensing element is searched for the center line with which the amplitude distribution curve at the time of setting out of the optimal press location by the optimal press position control means 76 was set up beforehand, That is, based on a gap of the symmetric property of the amplitude distribution curve acquired actually after that centering on the center position pressure sensing element (active element) location set up by the optimal press position control means 76, the location gap to the press side 54 of a radial artery 56 is judged. Since the above-mentioned amplitude distribution curve is also called tonogram and the amplitude falls in inverse proportion to distance with a radial artery 56, the maximum location of the amplitude distribution curve has the property which carries out abbreviation coincidence with the core of a radial artery 56.

[25] For example, each change condition of the area of the couple of the predetermined section of both sides when the center line of the above-mentioned artery gap judging means 82 is pinched among said amplitude distribution curves, for example, the center line with which the criteria amplitude distribution curve at the time of the renewal of setting out the optimal press location by said optimal press position control means 76 or renewal of response relation (criteria tonogram) was set up beforehand, Namely, area SL of the couple of the predetermined section of the both sides which crosses across the center position pressure sensing element (active element) location set up by the optimal press position control means 76 And SR Change of a difference, Or area SL of these couples And SR Change rate $\Delta SL / SL$ And $\Delta SR / SR$ A gap of an artery is judged based on a difference. The above-mentioned ΔSL And ΔSR It is a part area change of the predetermined section of the both sides said whose center lines in a actual amplitude distribution curve are pinched.

[26] The press location correction means 84 is the process which measures presumed blood pressure continuously with said presumed blood-pressure value decision means 74. When the gap to the press side 54 of the pulse wave sensor of a radial artery 56 is judged by the above-mentioned artery gap judging means 82 In the condition [that the thrust of the pressure pulse wave sensor 46 is maintained by the optimal thrust with said optimal press force-control means 80] The pulse wave sensor 46 is moved to crosswise migration equipment 64 so that a location gap of a radial artery 56 may decrease, namely, so that the center line of a actual amplitude distribution curve may be in agreement with the center position pressure sensing element (active element) location set up beforehand.

[27] Drawing 8 and drawing 9 are the flow charts explaining the important section of control actuation of the above-mentioned arithmetic sequence unit 28, drawing 8 shows a main routine and drawing 9 shows the press location correction control routine which corrects the press location of the pressure pulse wave sensor 46 for decision actuation of presumed blood pressure during activation continuously.

[28] At step S1 (a step is skipped hereafter.) of drawing 8, it is judged whether the elapsed time after response actuation is updated by whether it is activation of the first time of S1 and last time exceeded the calibration period set up about ten minutes thru/or about dozens of minutes beforehand. Usually, since the decision of S1 is denied, it is judged whether it changed into the condition that what detects the maximum amplitude of the pressure sensing elements

anged [whether in S2, the predetermined renewal conditions of a press location (APS starting conditions) were satisfied and] in the press side 54 of the pressure pulse wave sensor 46 is located in the edge of the array locations.

29] If the press location of the pressure pulse wave sensor 46 to a radial artery 56 is a normal range, since decision of above S2 will be denied [whether the body motion to which the press conditions of the pressure pulse wave sensor are changed in S3, so that the response relation of drawing 4 is changed was detected, and] Or it is judged whether it is satisfied based on whether it changed substantially to the blood-pressure value BP by which the monitor blood-pressure value MBP was measured using the last cuff 10, the starting conditions, i.e., the HDP starting conditions, for relating the response relation for a blood-pressure monitor.

30] It is the pressure pulse wave signal SM 2 whether since decision of the above S3 was denied when it was thought that there is no change in the press conditions of the pressure pulse wave sensor 46, and the response relation of drawing 4 is not changing, one pressure pulse wave occurred in S8. It is based and judged. When this decision of S8 is denied, it is made to stand by by performing S1, S2, S3, and S8 repeatedly. However, if one pressure pulse wave is inputted and decision of S8 is affirmed, it will set to S9 corresponding to said presumed blood-pressure value decision means 74. Pressure pulse wave signal SM 2 from the pressure pulse wave sensor 46 currently pressed by the optimal thrust PHDPO from -- The peak price PMmax and the minimum value PMmin of the wave motion are determined, and it is based on the peak price PMmax and the minimum value PMmin of the pressure pulse wave from the response relation of drawing 4, and is the highest-blood-pressure value MBPSYS. And while the lowest-blood-pressure value MBPDIA (presumed blood-pressure value) is determined The determined presumed blood-pressure value is serially displayed on a drop 32 for every beat with the continuous wave form of the presumed blood-pressure value MBP.

31] Since said decision of S1 will be affirmed if the elapsed time after response relation is determined as last time, while the above step is performed repeatedly exceeds the calibration period set up beforehand, after blood pressure measurement using a cuff 10 is performed in S6, response relation is updated in S7 and less than [the / account Soft switch to front 8] is performed. namely, by S6 corresponding to said blood-pressure value measurement means 70, first after the exhaust air control valve's 16 operating a switch and an air pump 18 in the pressure supply condition and raising out pressure up of the pressure in a cuff 10 to the target prepressure force (for example, 180mmHg(s)) higher than the highest-blood-pressure value a patient is expected to be, By making it descend at the **** pressure-lowering process to which the air pump 18 was stopped, and the exhaust air control valve 16 was switched to the **** exhaust-gas-pressure condition, and the pressure in a cuff 10 was beforehand set by 3 mmHg/sec extent Pulse wave signal SM 1 serially acquired in this **** pressure-lowering process It is based on change of the amplitude of the pressure pulse wave to express. While the highest-blood-pressure value BPSYS, the mean-blood-pressure value BPMEAN, and the lowest-blood-pressure value BPDIA (criteria blood-pressure value) are measured according to the blood-pressure value decision algorithm of an oscillograph metric method known well, a pulse rate etc. is determined based on pulse wave sensing. And while the blood-pressure value, pulse rate, etc. which were measured are displayed on a drop 32, the exhaust air control valve 16 is switched to a rapid exhaust-gas-pressure condition, and exhaust gas pressure of the inside of a cuff 10 is carried out quickly.

32] Next, blood-pressure values BPSYS and BPDIA by the cuff 10 measured in S7 corresponding to said related decision means 72 in the magnitude (an absolute value, i.e., magnitude of the pressure pulse wave signal SM 2) of the pressure pulse wave from the pressure pulse wave sensor 46, and the above S6 The response relation of a between is based for and updated. Namely, highest-blood-pressure value BPSYS measured by the cuff 10 in the peak price PMmax of these pressure pulse waves and the minimum value PMmin, and S6 while one beat of pressure pulse waves from the pressure pulse wave sensor 46 was read and the peak price PMmax and the minimum value PMmin of the pressure pulse wave were determined And lowest-blood-pressure value BPDIA It is based and the response relation between the magnitude of a pressure pulse wave and the blood-pressure values which are shown in drawing 4 is determined.

33] The press location to the radial artery 56 of said pressure pulse wave sensor 46 shifts greatly. When the predetermined renewal conditions of a press location at the time of becoming that to which what detects the maximum amplitude of the pressure sensing elements arranged in the press side 54 is located in the edge of the array locations etc. is satisfied In the APS control routine of S4 corresponding to said optimal press position control means 76 since said decision of S2 is affirmed While the optimal press location for the center position pressure sensing element which is the maximum amplitude location of the amplitude distribution curve of drawing 7 to make it located in the center of deviation of the press side 54 is determined In the HDP control routine of S5 corresponding to said optimal press position-control means 80 after the center position pressure sensing element at that time was set up as an active element and the pressure pulse wave sensor 46 was positioned in the optimal press location After the thrust from which the maximum amplitude of the pressure pulse wave detected by the center position pressure sensing element located right above an artery 56 is obtained was determined as optimal thrust PHDPO and updated in the process in which the thrust

the pressure pulse wave sensor 46 is heightened continuously, The thrust of the pressure pulse wave sensor 46 is held the optimal thrust PHDPO. And where the pressure pulse wave sensor 46 is pressed by the optimal thrust PHDPO, S_6 is performed. Moreover, when decision of the above S_2 is denied and said decision of S_3 is affirmed, below the HDP control routine of the above S_5 is performed.

[34] Under the actuation by which the thrust of the pressure pulse wave sensor 46 is held by the optimal thrust PHDPO, and a living body's blood-pressure value is hereafter supervised continuously in the above-mentioned main routine, That is, in the period when S_1 , S_2 , S_3 , S_8 , and S_9 are performed repeatedly, the press location correction routine which corrects the press location of the pressure pulse wave sensor 46 so that the radial artery 56 which is detected when a gap of a radial artery 56 occurred may be pursued and a gap may be canceled is explained using drawing

[35] a ***** [that response-related updating (cuff calibration) shown in drawing 4 in S_7 corresponding to the stated decision means 72 was performed in SS1 of drawing 9] -- or in S_5 corresponding to the optimal press force-control means 80, it is judged whether the optimal thrust PHDPO of the pressure pulse wave sensor 46 was updated. When decision of this SS1 is denied, the thrust of the pressure pulse wave sensor 46 is held at that optimal thrust PHDPO, and SS3 or subsequent ones is performed. However, it is the area SL of the predetermined field of the both sides whose center lines of that criteria amplitude distribution curve are pinched as shown in drawing 7 while a criteria amplitude distribution curve (criteria tonogram) is memorized in SS2, when decision of this SS1 is affirmed. And SR is computed.

[36] subsequently, in SS3, in order to remove a variation, the averaging operator of the amplitude distribution curve (tonogram) which was alike till then and was acquired for every beat from the last gap judging or later is performed, and a mean amplitude distribution curve (average tonogram) equalized by the predetermined within a time one is acquired. A decision-criterion value NM to which the content "N" of the number counter CN of beats which carries out counting of the number of beats was beforehand set in SS4 It is judged whether it became the above. This decision-criterion value NM It corresponds to a gap judging period and the value equivalent to several beats thru/or about ten beats is set up. In this SS4, it may be judged whether the decision-criterion time amount to which the elapsed time from the last gap judging or later was set beforehand was reached.

[37] Since decision of the above SS 4 was denied, after "1" is added to the content "N" of the above-mentioned number counter CN of beats in SS5 at the beginning, said three or less SS is performed again. And if decision of the above SS 4 is affirmed while the above [SS / SS and / 5] 3 is performed repeatedly, it will set to SS6 corresponding to the radial artery gap judging means 82. Area change part ΔSL of a mean amplitude distribution curve to said criteria amplitude distribution curve And ΔSR While being computed, respectively Area rate-of-change $\Delta SL / SL$ of determined within the limits of right and left of the center line of a criteria amplitude distribution curve And $\Delta SR / SR$ Based on difference $(\Delta SL / SL) - (\Delta SR / SR)$, it is judged whether the gap to the press side 54 of the pressure wave sensor 46 of a radial artery 56 occurred.

[38] For example, since decision of the above SS 6 will be denied if above-mentioned difference $(\Delta SL / SL) - (\Delta SR / SR)$ is the value of zero or its near, the press location of the direction which crosses the radial artery 56 of the pressure wave sensor 46 in SS7 is held in the location till then. However, since decision of the above SS 6 will be affirmed it is the forward value or the forward negative value of magnitude more than the absolute value to which above-mentioned difference $(\Delta SL / SL) - (\Delta SR / SR)$ was set beforehand In SS8 corresponding to said press location correction means 84, in the condition [that the thrust of the pressure pulse wave sensor 46 is maintained by the optimal thrust with the optimal press force-control means 80 (S_5)] Only a predetermined value is moved in the direction where the gap to the press side 54 of the pulse wave sensor 46 of a radial artery 56 decreases with crosswise migration of the pulse wave sensor 46. For example, -- the case where it is negative although the pulse wave sensor 46 is moved to left-hand side, i.e., a radius side, when above-mentioned difference $(\Delta SL / SL) - (\Delta SR / SR)$ is forward -- the pulse wave sensor 46 -- right-hand side, i.e., a tendon, -- it is moved to a side.

[39] As mentioned above, according to this example, it sets during the continuous blood-pressure monitor using assumed blood pressure. When the gap to the press side 54 of the pulse wave sensor 46 of a radial artery 56 is judged the artery gap judging means 82 (SS6) So that a location gap of the pulse wave sensor 46 may decrease with the press location correction means 84 (SS8) in the condition [that the thrust of the pressure pulse wave sensor 46 is maintained by the optimal thrust with the optimal press force-control means 80 (S_5)] with crosswise migration of the pulse wave sensor 46 The pulse wave sensor 46 is moved. For this reason, since the location gap to the criteria location, for example, the center position pressure sensing element, of the press side 54 of a radial artery 56 is canceled without requiring optimal press localization actuation and optimal thrust decision actuation, a blood-pressure monitor is continued properly. [of the pressure pulse wave sensor 46] [0040] According to this example, moreover, the artery gap judging

ans 82 (SS6) In the condition that the thrust of the pressure pulse wave sensor 46 is maintained by said optimal thrust h said optimal press force-control means 80 (S5), and a living body's presumed blood-pressure value is determined the presumed blood-pressure value decision means 74 (S9) It is based on the pressure pulse wave detected by two or re pressure sensing elements of the pressure pulse wave sensor 46. It sets a 2-dimensional coordinate (drawing 7) as location shaft in which the location of the amplitude shaft in which the amplitude of the pressure pulse wave is wn; and the above-mentioned pressure sensing element is shown. It asks, the amplitude distribution curve, i.e., the ogram, in the press side 54 which shows the relation between the amplitude of the pressure pulse wave, and the ation of a pressure sensing element, and the location gap to the criteria location of the press side of said artery is ged based on the symmetric property centering on the center line with which the amplitude distribution curve was set beforehand. More specifically the above-mentioned artery gap judging means 82 (SS6) each change condition 80), for example, the optimal press force-control means, of the predetermined section of area, [of the both sides said ose center lines are pinched among the above-mentioned amplitude distribution curves] [of a couple] When the ssure pulse wave sensor 46 is pressed by the optimal thrust by press equipment 62 Area SL of the couple of the determined section of the both sides said whose center lines in a ***** distribution curve are pinched And SR ange rate $\Delta SL / SL$ And $\Delta SR / SR$ A gap of an artery is judged based on a difference. For this reason, there are uracy and an advantage which can judge a gap of a radial artery 56 easily comparatively.

41] As mentioned above, although one example of this invention was explained based on the drawing, this invention plied also in other modes.

42] For example, in the above-mentioned example, it sets for the pulse wave gap judging means 82 (SS6). Area rate-change $\Delta SL / SL$ of predetermined within the limits of right and left of the center line of a criteria amplitude istribution curve And $\Delta SR / SR$ Although it was judged based on difference $(\Delta SL / SL) - (\Delta SR / SR)$ whether gap of an artery occurred Area SL of a couple And SR A difference or area increment ΔSL And ΔSR A gap of artery may be judged based on a ratio.

43] Moreover, although SS2, SS4, and SS5 for computing a mean amplitude distribution curve were prepared in the mple of above-mentioned drawing 9 , it does not necessarily need to be prepared.

44] Moreover, in the above-mentioned example, in order that an overarm might be equipped with a cuff 10 and the ssure pulse wave sensor 46 might detect the pressure pulse wave of a radial artery, the wrist was equipped, but the de peg may be equipped, in order that a cuff 10 may be wound around a femoral region and the pressure pulse wave sor 46 may detect the pressure pulse wave of the arteria dorsalis pedis of the near leg around which the cuff 10 is not und.

45] Moreover, in the above-mentioned example, in order to decrease a gap of a radial artery 56 with the press ation correction means 84, when the location of the pressure pulse wave sensor 46 is changed and presumed blood ssure changes a predetermined value or more than a predetermined rate, S6 less or equal corresponding to said blood- ssure value decision means 70 may be made to carry out automatically.

46] Moreover, the blood-pressure value measurement means 70 of the above-mentioned example was constituted so t blood pressure might be measured by the so-called oscillograph metric method, but even if it carries out blood ssure measurement with the so-called K sound method which determines the cuff pressure at the time of generating Korotkoff sounds, and dissipation as a highest-blood-pressure value and a lowest-blood-pressure value, it does not erfere.

47] In addition, in the range in which this invention does not deviate from the main point, modification may be led variously.

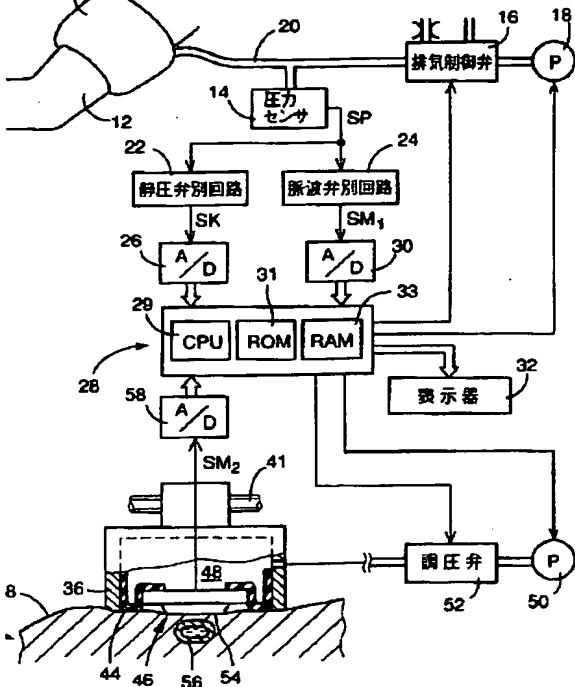
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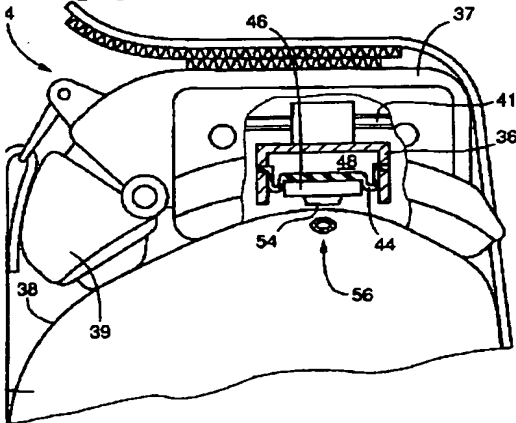
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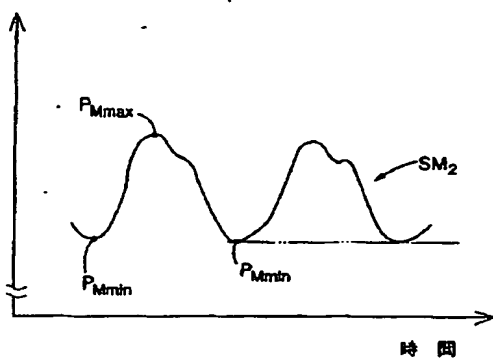
AWINGS

awing 1]

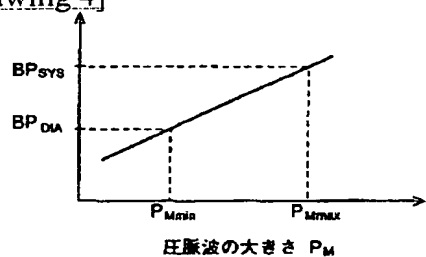


cawing 2]

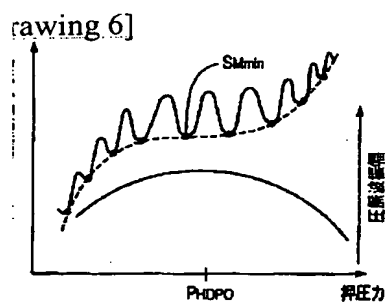
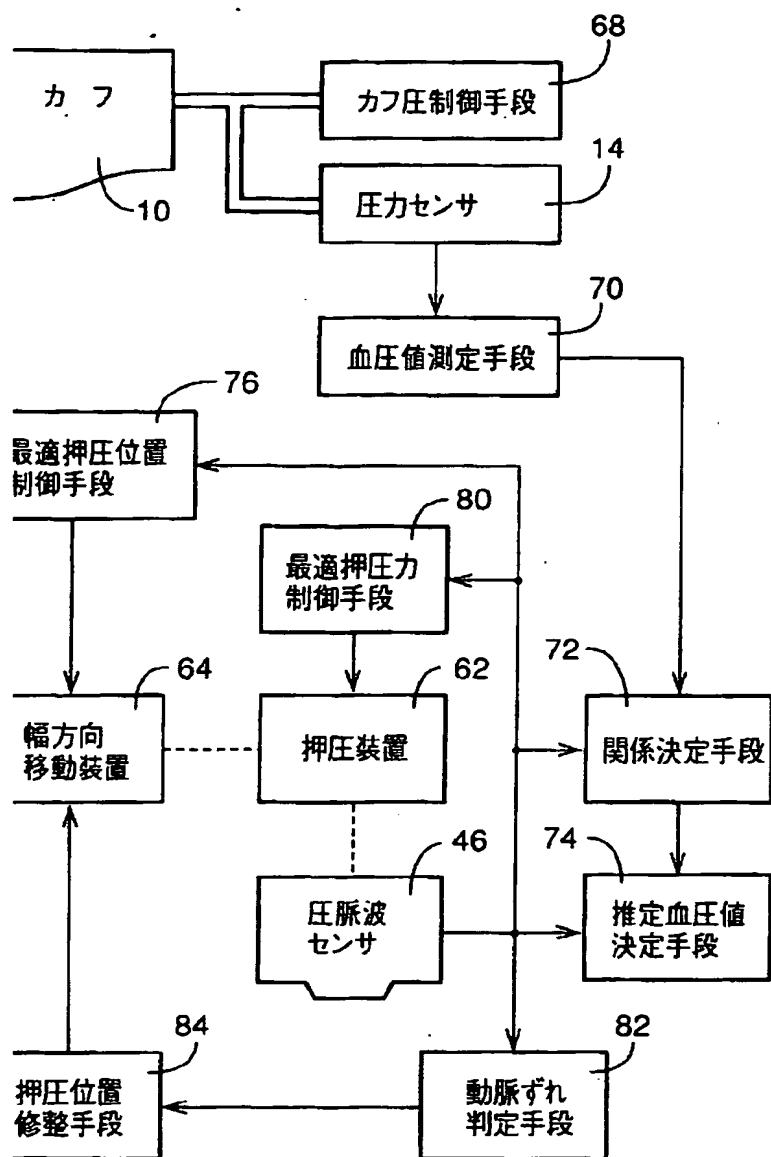




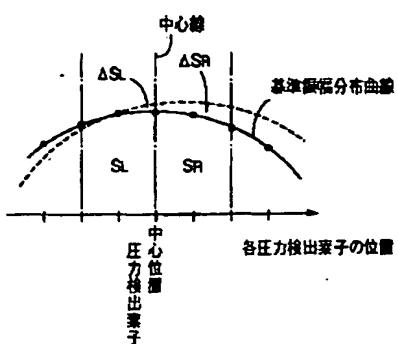
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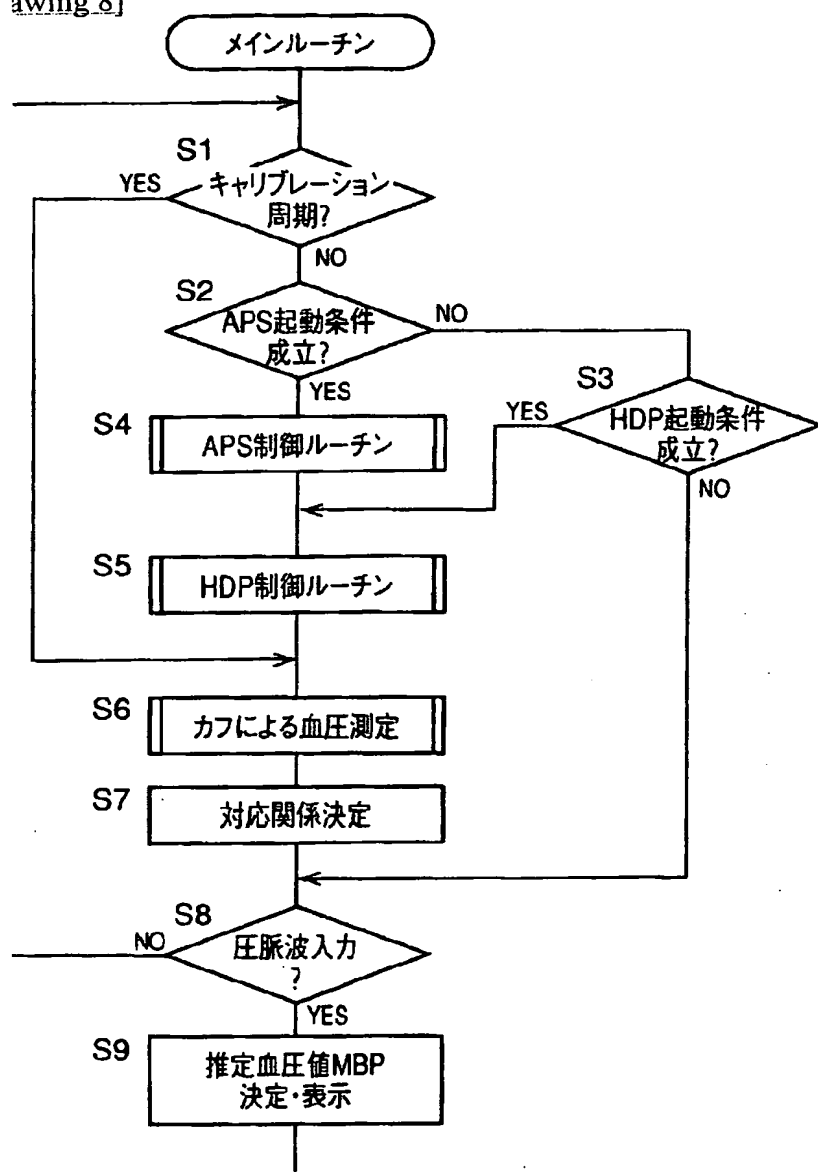
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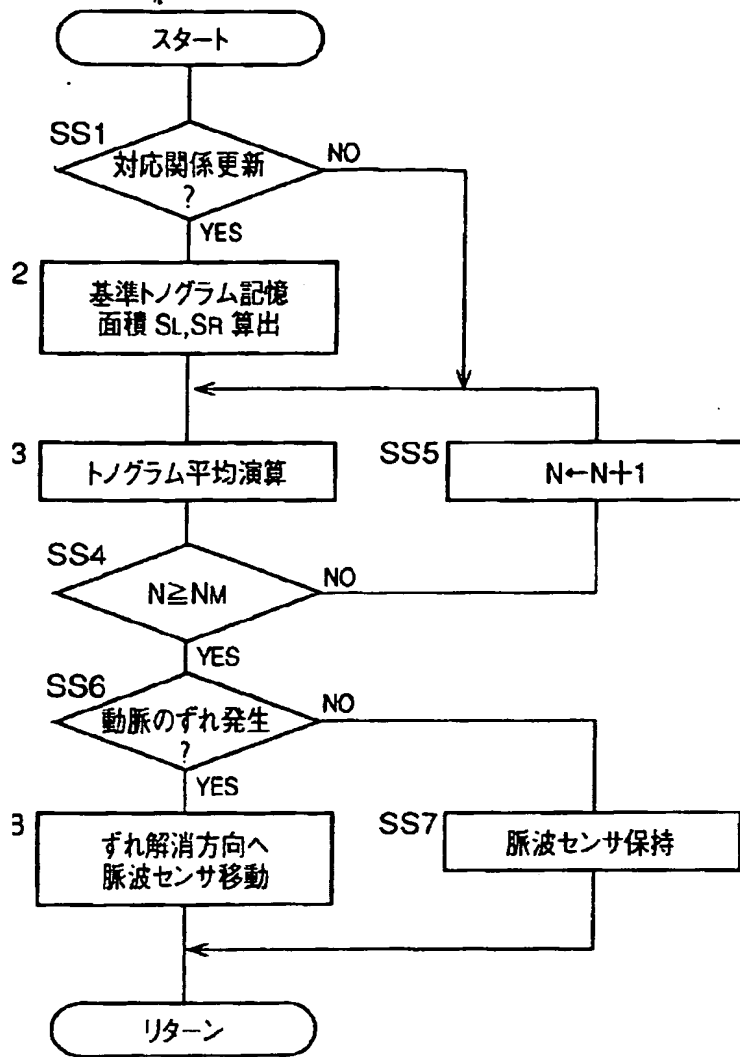
rawing 7]



rawing 8]



rawing 9]



anslation done.]